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Examination of Interaction between Augmented Reality and Traditional Cultural Experiences

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1. Introduction

According to the World Tourism Organization [1], international tourist arrivals have reached the 1.4 billion mark and export earnings generated by tourism have grown to 1.7 trillion USD. The tourism industry is one of the most influential and important industries in the world.

In recent years, it has been required to experience the culture of each destination through sightseeing [2]. Cultural experiences include visiting famous heritage site, participating in cultural events, and experiencing traditional culture. In our study, we focused on the traditional cultural experiences.

Watching Kabuki, a Japanese traditional performing art [3], and Zen retreat experience unique to Buddhist tourism [4] are typical examples of traditional cultural experiences in tourism. Such traditional cultural experiences are considered to be useful for improving the satisfaction of tourists. However, at the same time, there are some issues regarding the financial costs of tourists and the cost of human resources on the host side to support the experience.

Therefore, we focused on the traditional cultural experiences using augmented reality (AR.) AR is well known to be effective in improving the cultural tourism experience [5]. However, it has not yet been clarified what kind of traditional culture experience using AR is worthwhile to tourists and the traditional culture. The goal of our research is to clarify the interaction between AR and cultural tourism experiences, and to realize a collaboration between AR and real space for high quality traditional cultural experiences.

To achieve the goal, we developed an application which allows tourists to experience Tosenkyo, which is one of the representative traditional cultures of Japan, by utilizing AR. In addition, we designed and examined an experiment using the application to clarify the interaction between AR and traditional cultural experiences.

2. Hypotheses

In our study, the following two elements, which are necessary for experiencing the traditional culture but can be complemented using AR, are targeted.

1. *Equipment Elements* which are indispensable for experiencing the traditional culture.

2. *Environment Elements* which are not always necessary for experiencing the traditional culture, but are important for constructing the atmosphere of it.

The following hypothesis about these two elements was constructed.

Hypothesis 1

Environment Elements are effective for bringing a traditional culture experience using AR closer to the actual one.

Traditional cultural experiences using AR requires an experience which is as close as possible to the actual traditional cultural experiences. Steuer [6] defined presence as "the sense of being in an environment" and showed that presence is an important factor in improving the performance of media. Furthermore, it was revealed that social presence is strongly related to the technical aspect among presence and the social presence grows stronger with less artificially mediated experiences [7].

It is speculated that a similar interaction could occur in the traditional cultural experiences using AR. In other words, it is predicted that the less information artificially complemented by AR is, the closer the traditional cultural experiences using AR are to the actual traditional cultural experiences.

From the above, the following hypothesis regarding the interaction between AR and traditional cultural experiences was established.

Hypothesis 2

The less information complemented by AR is, the closer the traditional cultural experiences using AR are to the actual experiences, and the higher the satisfactions of the experiencing people are.

The stimulus-organism-response (SOR) theory [8] in behavioral psychology has been applied in various studies on the behavior of tourists [9,10]. In particular, Kim *et al.* [11] applied this theory to virtual reality (VR) and clarified that experiencing a tourist destination using VR increases the desire to actually visit the tourist destination.

Thus, we speculated that the SOR theory can be applied to traditional cultural experiences using AR, and constructed the following hypothesis.

Hypothesis 3

The traditional cultural experiences using AR increase the interests in traditional cultures and the desire for actual traditional cultural experiences.

3. Tosenkyo: traditional cultural experience using augmented reality

In our study, Tosenkyo is chosen as a traditional cultural experience. Tosenkyo is a traditional Japanese play using a Japanese hand fan. In Tosenkyo, experiencing people throw the fan at a ginkgo-shaped target called "Chou" which stands on the base of a paulownia box. Then, the shape called "Mei" made by the fallen fan and Chou is scored using the score table

associated with The Tale of Genji.

Various tools such as Chou and Mei are required to actually experience Tosenkyo. However, it is possible to complement those tools with the Tosenkyo application which we developed. Figure 1 shows the user interfaces of the Tosenkyo application.

We consider the elements to be complemented by AR. As mentioned earlier, Chou, Mei, a Japanese hand fan and a paulownia box, which are indispensable tools for experiencing Tosenkyo, correspond to the Equipment Elements. Also, Tosenkyo is often experienced on a red carpet as shown in Figure 1. This red carpet is not always necessary for the Tosenkyo experience. However, it is an important element which constitutes the atmosphere of the traditional cultural experience. Therefore, the red carpet corresponds to the Environmental Elements.

4. Experiment design

In order to verify these hypotheses, three patterns of experiments as shown in Table 1 are designed. In Table 1, the notation "Real" indicates that the target element is actually prepared, and the notation "AR" indicates that the target element is complemented by AR.

Questionnaire surveys will be conducted before and after each experiment. In this survey, we ask about the following three themes.
1. Usability of the Tosenkyo application.
2. Whether the experience using the application is close to the actual experience.
3. Interest in the actual experience.

Through these experiments, hypothesis 1 will be verified with comparing the results of pattern A to the results of pattern B, C. Similarly, hypothesis 2 will be verified by comparing the results of pattern B to the results of pattern C. Furthermore, hypothesis 3 will be verified with comparing the results of the questionnaire conducted before the experience to the results of the questionnaire conducted after the experience

Focusing on the three themes mentioned above, it is especially important to determine the question items related to "whether the experience using the application is close to the actual experience." Therefore, in order to examine these question items, interview surveys with people who have actually experienced Tosenkyo and experts in Tosenkyo will also be conducted.

5. Conclusion

The goal of our study is clarifying the interaction between AR and cultural tourism experiences. It leads to realize a collaboration between AR and real space for high quality traditional cultural experiences. To achieve the goal, we focused on Tosenkyo and developed the Tosenkyo application using AR. Furthermore, we constructed three hypotheses about the interaction between AR and traditional cultural experiences, and designed an experiment to verify these hypotheses. In the future, we plan to carry out the designed experiments.
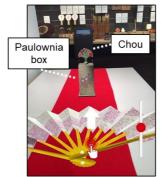

Figure 1: User interfaces of Tosenkyo application.

Table 1: Three patterns of experiments.

	Equipment Elements	Environment Elements
Pattern A	AR	-
Pattern B	AR	AR
Pattern C	AR	Real

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